SCRAM: A Method for Assessing Schedule Compliance Risk

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What does SCRAM mean?

- Go away!
- Secure Continuous Remote Alcohol Monitoring
  - As modeled here by Lindsay Lohan
- Schedule Compliance Risk Assessment Methodology

SCRAM

Schedule
Compliance
Risk
Assessment
Methodology

- Collaborative effort:
  - Australian Department of Defence - Defence Materiel Organisation
  - Systems and Software Quality Institute, Brisbane, Australia
  - Software Metrics Inc., Haymarket, VA

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DMO SCRAM Usage

- SCRAM has been sponsored by the Australian Defence Materiel Organisation (DMO)
  - To improve our Project Schedule Performance in response to Government concern as identified by the Australian National Audit Office (ANAO)
    - ANAO is equivalent to the US Government Accountability Office (GAO)

- DMO equips and sustains the Australian Defence Force (ADF)
  - Manages 230+ Major Capital Equipment Projects & 100 Minor (<$20M) defence projects

DMO SCRAM Usage (cont.)

- SCRAM has evolved from our reviews of troubled programs
  - Schedule is almost always the primary concern of program stakeholders (delays to war fighter capability unacceptable)
  - SCRAM is a key component of our initiative to identify and remediate (and eliminate) root cause of schedule slippage

Topics

- Three Common Questions Addressed by SCRAM
- Benefits of Using SCRAM
- SCRAM Key Principles
- SCRAM Process
- Future plans for SCRAM

Three Common Questions

- SCRAM addresses three fundamental questions.
  1. Why is schedule slipping?
     - Root cause analysis
  2. Is the schedule credible?
     - Assess risk and identify Issues (including estimated rework)
     - Assess BoEs (Basis of Estimate)
     - Perform schedule “Health Check”
     - Perform Monte Carlo analysis using inputs from other SCRAM areas
  3. How can future slips be prevented?
     - General recommendations based on SCRAM review findings
     - Guidance on “leading indicators” of slippage

What SCRAM is Not

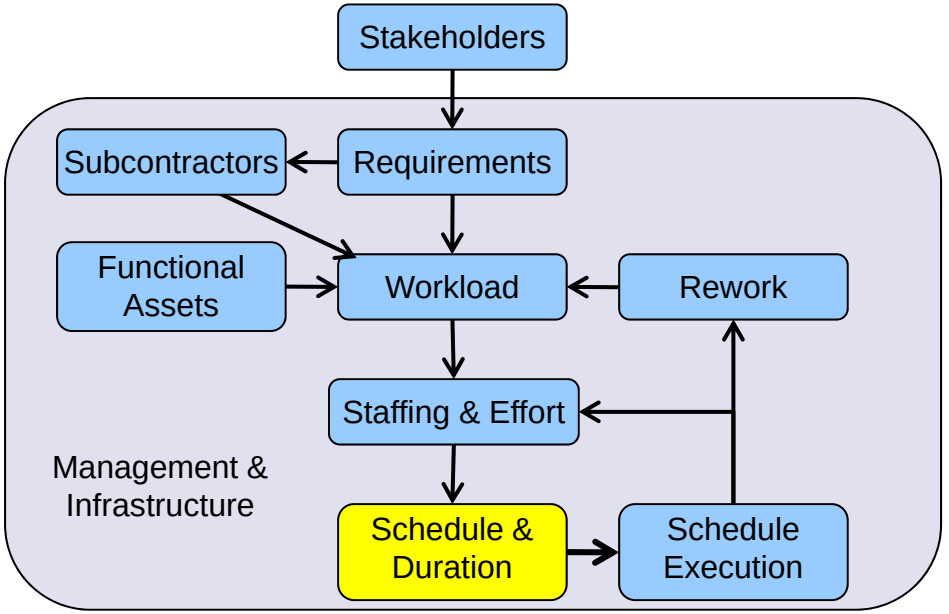
- Not an assessment of technical feasibility
- Not an assessment of process capability
  - However, may be identified and treated as an issue if process performance is identified as contributing to slippage

Why is schedule slipping?

- Program managers are flooded with a wealth of data and details
  - Challenge is to organize all of this information
    - Identify cause(s) of slippage
    - Schedule slippage is a symptom of other factors
    - Take effective action to address problems
  - Organizing the information based on SCRAM should:
    - De-clutter the massive amounts of information on a project
    - Relate the different issue areas to each other
    - Highlight missing information
- SCRAM is based on a “Root Cause Analysis of Schedule Slippage - RCASS” model

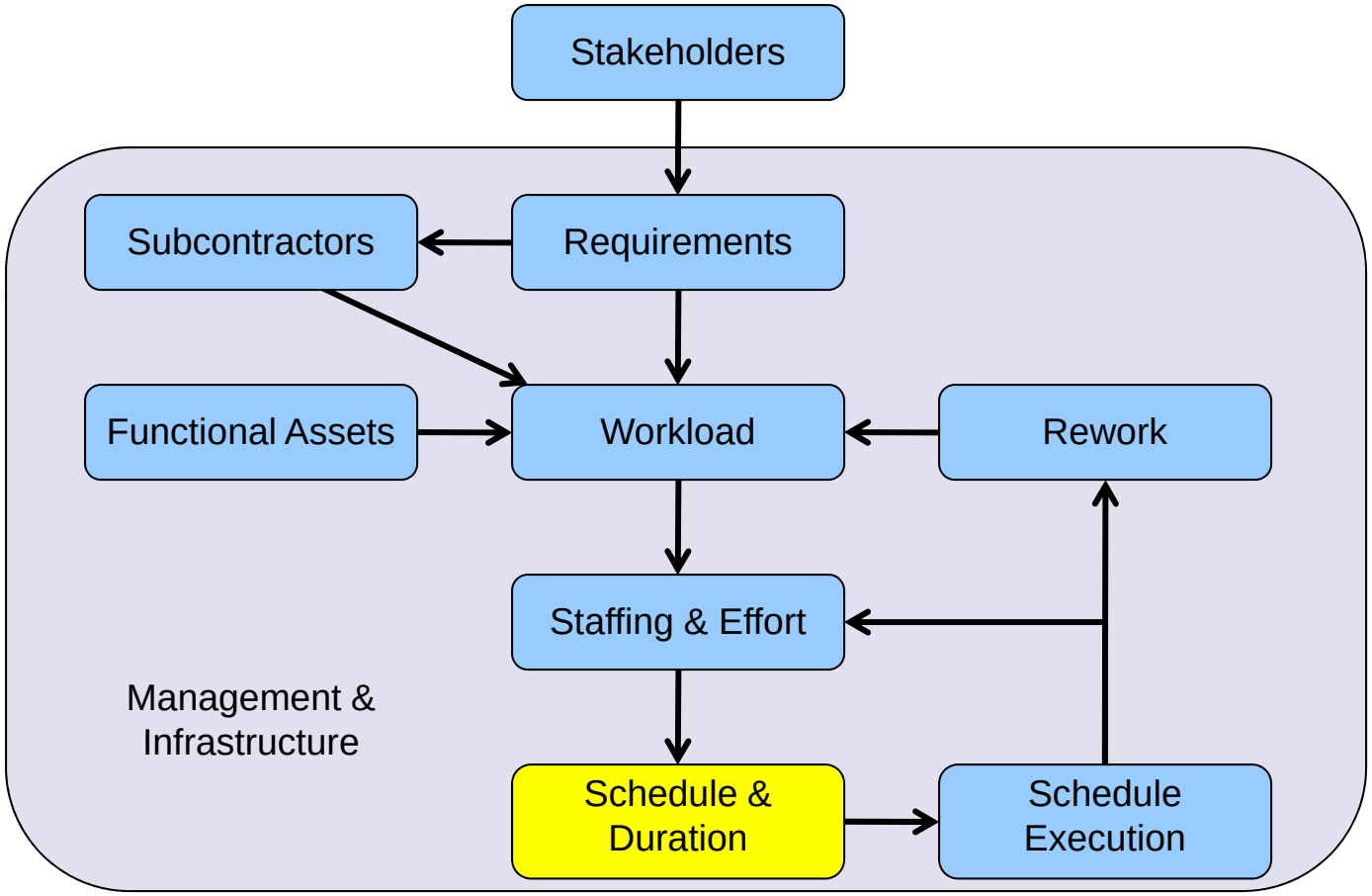
Root Cause Analysis of Schedule Slippage (RCASS) Model

- After many assessments, refined RCASS for guidance in:
  - Categorizing the wealth of data and details
  - Assessing the causes of slippage
  - Recommending a going-forward plan



Adapted from Integrated Analysis Model in McGarry et al., ***Practical Software Measurement: Objective Information for Decision Makers***

SCRAM-RCASS



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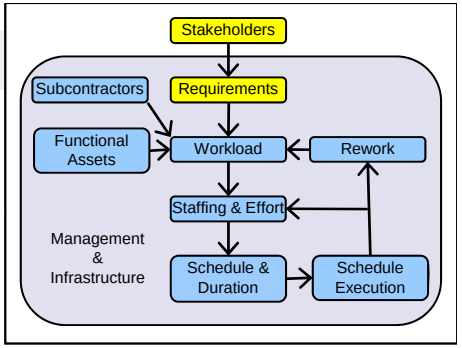
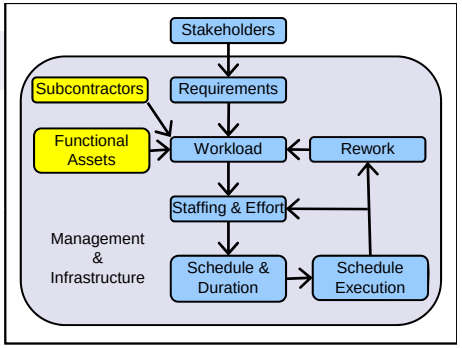
Root Cause Analysis - Examples



- Stakeholders
  - "Our stakeholders are like a 100-headed hydra – everyone can say 'no' and no one can say 'yes'."

- Requirements
  - Misinterpretation of a communication standard led to an additional 3,000 requirements to implement the standard.

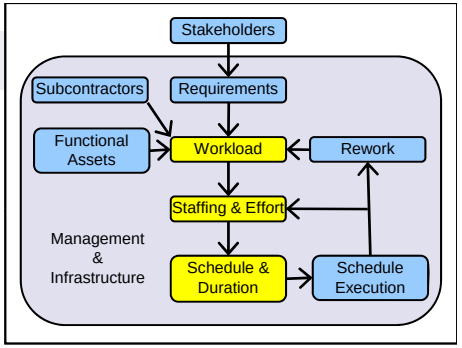
Root Cause Analysis - Examples



- Subcontractor
  - Subcontractor omitting processes in order to make delivery deadlines led to integration problems with other system components.

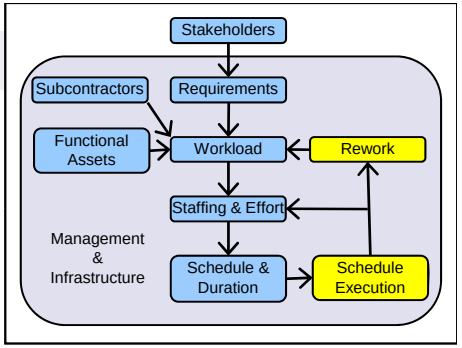
- Functional Assets (COTS/MOTS)
  - Commercial-off-the-shelf (COTS) products that do not work as advertised, resulting in additional work or replacement with different products.
  - Underestimating amount of software code that must be written/modified in a legacy system.

Root Cause Analysis - Examples



- Workload
  - Optimistic estimates
    - Source lines of code underestimated
    - Contract data deliverables workload often underestimated by both contractor and customer
- Staffing & Effort
  - High turnover, especially among experienced staff
- Schedule & Duration
  - Area of primary interest

Root Cause Analysis - Examples



- Schedule Execution
  - Schedule replans are not communicated to program staff or stakeholders
  - Lack of, or poorly integrated, master schedule
  - Integrated schedule elements not statused consistently across program. Actual status unknown.
  - External dependencies not integrated or tracked
- Rework
  - Often underestimated or not planned for (e.g. defect correction)
- Management & Infrastructure
  - Lack of adequate test facilities (in terms of fidelity or capacity)

Three Common Questions

1. Why is schedule slipping?
   - Root Cause Analysis of Schedule Slippage - RCASS model guides the analysis approach
2. Is the current schedule credible?
   - Assess the risks and issues
   - Assess the BoEs (Basis of Estimate)
   - Perform “Schedule Health Checks”
   - Perform Monte Carlo analysis
3. How can future slips be prevented?

Assess the Risks and Issues

- Are risks and issues understood and managed?
- What mitigations are in place to address the risks?
- Have the issues been analyzed to determine corrective actions?
  - Are corrective actions being managed through to closure?
- Is there contingency in the schedule if risks are realized?
  - Or is the schedule so tight that nothing can go wrong?

Assess the BoEs

- Technical expertise is essential
- Basis of estimate will vary by phase and activity
  - Requirements
  - Source Lines of Code
  - Test cases/procedures
- Evidence of use of historical data, models

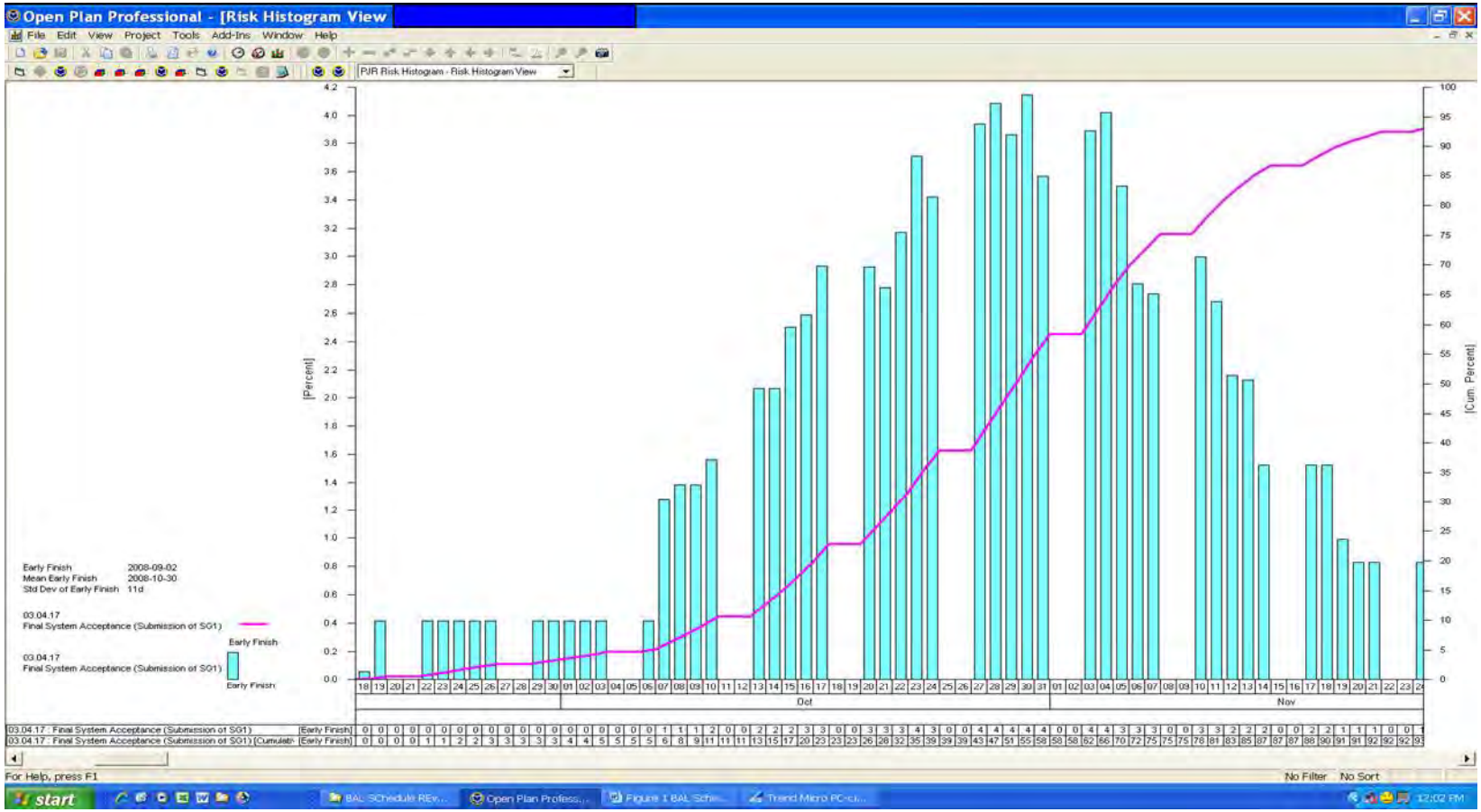
Schedule Health Checks

- To evaluate schedule construction and logic
  - Includes analyses of task dependencies, task constraints, and available schedule float
- WBS and Master Schedule are reviewed for alignment
- Government, Prime, and Subcontractor schedule integration / alignment is reviewed
- Ensure external dependencies are included and linked in the schedule
  - Interfaces, resources, facilities, Government Furnished Equipment (GFE), test assets etc.

Schedule Health Checks (cont.)

- Allocate three point estimates to tasks on critical and near-critical path based on identified risk from RCASS
  - optimistic, pessimistic & most likely task duration
- Perform Schedule Risk Simulation (e.g. Monte Carlo)

Monte Carlo Analysis Example



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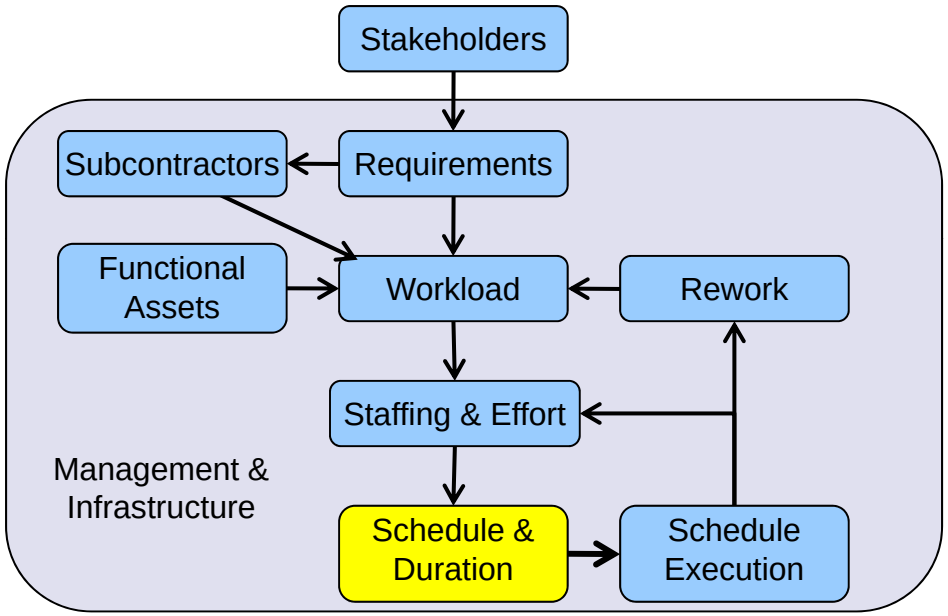
3. How can future slips be prevented?
   - General recommendations based on SCRAM assessment
   - Guidance on measurements to serve as “leading indicators” of future slippage

SCRAM Recommendations - Examples

- Clarify the delivery scope (requirements and acceptance criteria)
- Create an Integrated Master Schedule
- Test Procedure development should be more closely tracked and time should be added to the schedule for their review and correction
- Additional time in all test phases should be added for re-running tests that fail or are blocked
- Enhance fidelity of integration lab to improve defect identification

Root Cause Analysis of Schedule Slippage Model

- Provides guidance for <u>collection of measurements</u>
  - For visibility and tracking in those areas where there are risks



Topics

- Three Common Questions Addressed by SCRAM
- Benefits of Using SCRAM
- SCRAM Key Principles
- SCRAM Process Reference / Assessment Model
- Future plans for SCRAM

SCRAM Benefits

- SCRAM root-cause analysis model (RCASS) useful in communicating the status of programs to all key stakeholders
  - Particularly executive management
- Identifies Root Causes of schedule slippage and permits early remediation action
- Provides guidance for collection of measures
  - Provides visibility and tracking for those areas where there is risk
- Provides confidence in the schedule

SCRAM - Benefit

- Validate schedule before execution
- Widely applicable
  - SCRAM can be applied at any point in the program life cycle
  - SCRAM can be applied to any major system engineering activity or phase
- Examples
  - Software-Hardware Integration
  - Aircraft Flight Testing
  - Installation/integration of systems on ship
  - Logistics ERP application roll out readiness

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SCRAM Key Principles

- Minimal Disruption
  - Information is collected one person at a time
  - Interviews typically last an hour
- Independent
  - Review team members are organizationally independent of the program under review
- Non-advocate
  - All significant issues and concerns are considered and reported regardless of origin or source (Customer and/or Contractor).
  - Some SCRAM reviews have been joint contractor/customer team – facilitates joint commitment to resolve outcomes

SCRAM Key Principles (cont.)

- Non-attribution
  - Information obtained is not attributed to any individual
  - Focus is on identifying and mitigating the risk
- Corroboration of Evidence
  - Significant Findings and Observations based on at least two independent sources of corroboration
- Rapid turn-around
  - One to two weeks spent on-site
  - Executive briefing presented at end of second week

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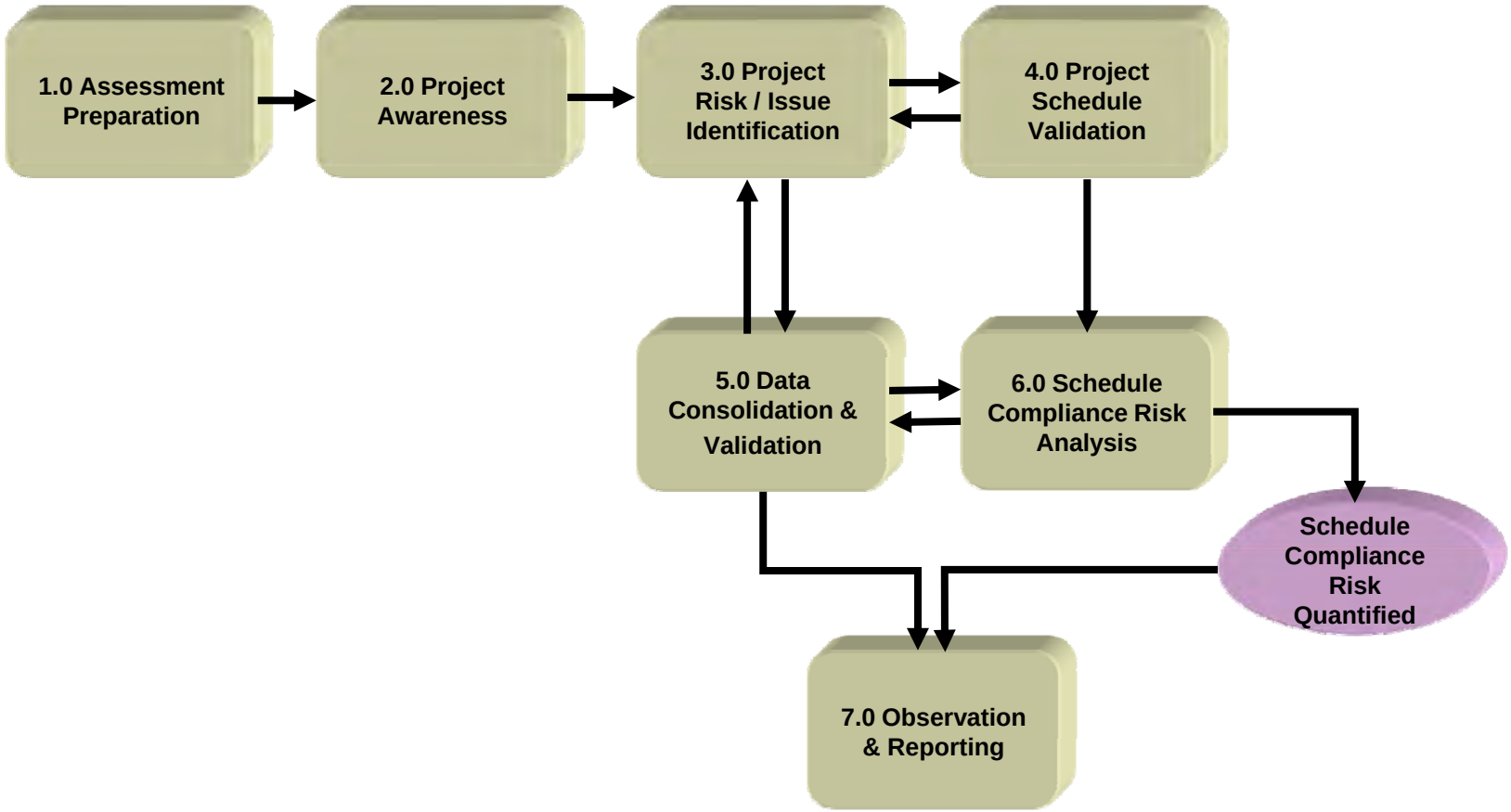
SCRAM Process



SCRAM Team Composition

- Assessment conducted by a small team including:
  - Engineering Assessors
    - Validate WBS, engineering-related basis of estimates (BoEs), work load estimates, technical risk assessment
  - Scheduler experienced in the project schedule tool
    - Validates schedule – conducts schedule health checks
    - Performs Monte Carlo risk modelling
  - Other project domain specialists as needed
    - E.g. Aeronautical Flight Test Engineers

SCRAM Key Steps

- SCRAM Team briefs the Project on the principles, purpose and approach of the SCRAM
- The Project provides the SCRAM team with an initial overview of the current status and project issues
- Project Issues and Risks are confirmed by the SCRAM Team through interviews, reviewing documentation and other project assets
- Schedule health checks and Monte Carlo analysis are performed

SCRAM Key Steps (cont.)

- Executive out brief is prepared and presented
  - Observations, findings and recommendations
  - Presentation structured using the RCASS model
    - Shows cause and effect linkage
  - Findings allocated a risk code rating
  - Presented at the end of the second week
- The final report is prepared and delivered (an additional two weeks)

SCRAM Findings - Examples

- Sample Findings with Risk Code Rating
  - POSITIVE:
    - Functional requirements based-lined and agreed; no evidence was identified of requirements churn or creep
  - POTENTIAL RISK:
    - Limited schedule contingency exists for further rework
  - HIGH RISK:
    - Lack of an integrated high-level schedule precludes the ability to accurately forecast project milestone achievements
      - 13 major schedules not integrated at the program level

Process Reference / Assessment Model

- Developed as an ISO/IEC 15504 conformant Process Reference Model and Process Assessment Model
  - Funded by the Australian Defence Materiel Organisation (DMO)
  - Developed by
    - Systems and Software Quality Institute and Software Metrics Inc.
  - Delivered June 2010
  - The models are publicly available to download from:

http://www.scramsite.org

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Future Plans

- Currently developed Diagnostic SCRAM (D-SCRAM)
  - Full scale application of the method to evaluate challenged projects or Projects of Concern.
  - Used to assess likelihood of schedule compliance, root cause of schedule slippage and to recommend remediation of project issues
- Further evolve the SCRAM process for:
  - Pro-active SCRAM (P-SCRAM)
    - To be conducted prior to Contract or at Integrated Baseline Review (IBR) to ensure common systemic issues are avoided before the Program Schedule is contracted or baselined
  - Monitor SCRAM (M-SCRAM)
    - Reduced version of D-SCRAM that maybe used to monitor project status – project health check performed ad hoc or conducted to support appropriate Gate Reviews

Future Plans (cont.)

- SCRAM Training & Assessor Qualifications
- SCRAM Process Reference and Assessment Model
  - Further revisions
    - Based on feedback from use during SCRAM assessments and
    - Change Requests (Appendix D in the model)
- SCRAM Assessment Tool
  - Prototype has been used
  - Under development

SCRAM

QUESTIONS

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Acronyms

- ANAO – Australian National Audit Office
- BoE – Basis of Estimate
- COTS/MOTS – Commercial off the Shelf/Modified off the Shelf
- DMO – Defence Materiel Organisation (Australia)
- GAO – Government Accounting Office
- GFE – Government Furnished Equipment
- ISO/IEC – International Organization for Standardization/International Electrotechnical Commission
- ISO/IEC 15504 – Information Technology – Process Assessment
- RCASS – Root Cause Analysis of Schedule Slippage
- SCRAM – Schedule Compliance Risk Assessment Methodology
- SMI – Software Metrics Inc. (United States)
- SSQi – Systems & Software Quality Institute (Australia)